associated with a third height range and a third weight, a fourth height bin **704** associated with a fourth height range and a fourth weight, a fifth height bin **705** associated with a fifth height range and a fifth weight, a sixth height bin **706** associated with a sixth height range and a sixth weight, and a seventh height bin **707** associated with a seventh height range and a seventh weight. Because the point cloud includes a significant number of points corresponding to the floor **408**, the first weight of the first height bin **701** is greater than a threshold **710**. Similarly, because the point cloud includes a significant number of points corresponding to the top of the table **409**, the fourth weight of the fourth height bin **704** is greater than the threshold **710**. The number of points at other heights are non-zero due to the point cloud including points corresponding to the side wall **406**, back wall **407**, and legs of the table **409**.

[0064] In various implementations, generating the height histogram includes, for an unpaired point of the plurality of points (in particular, for each of the unpaired points of the plurality of points), determining a height of the unpaired point based on the one of the three coordinates (e.g., the height coordinate) and incrementing, by an amount, one of the respective plurality of weights of the height histogram corresponding to the one of the plurality of non-overlapping height ranges including the height of the unpaired point. In various implementations, the amount is a fixed value, e.g., 1. For example, FIG. **7** illustrates a height histogram **700** with seven height bins **701-707** corresponding to seven non-overlapping height ranges.

[0065] In various implementations, generating the height histogram includes, for two paired points of the plurality of points (in particular, for each set of two paired points of the plurality of points), determining a height of a line defined by the two paired point based on the one of the three coordinates (e.g., the height coordinate) of each of the two paired points, determining a length of the line based on the others of the three coordinates of each of the two paired points, and incrementing, by an amount scaled by the length of the line, one of the respective plurality of weights of the height histogram corresponding to the one of the plurality of height ranges including the height of the line. In various implementations, the amount is a fixed value, e.g., **1**, scaled by the length of the line. Accordingly, two paired points defining a line increases the weight more than a single unpaired point or, in some embodiments, more than two unpaired points. In various implementations, incrementing the one of the respective plurality of weights is performed in response to determining that the line is substantially horizontal (e.g., with a threshold, such as 10%, of being horizontal). Thus, sets of paired points that define lines that are not substantially horizontal are ignored.

[0066] As noted above, in various implementations, each of the plurality of points is further associated with an uncertainty.

[0067] In various implementations, generating the height histogram includes, for an unpaired point of the plurality of points (in particular, for each unpaired point of the plurality of points), determining a height probability distribution of the point based on the one of the three coordinates (e.g., the height coordinate) and the uncertainty. Generating the height histogram further includes increasing a plurality of the respective plurality of weights of the height histogram corresponding to the probability distribution of the point. For example, an unpaired point of the point cloud may have a height coordinate of 1.01 and an uncertainty of ±0.2. Thus, the weight associated with a height range from 0.95-1.05 may be increased, and, also, the weights associated with a height range from 0.85-0.95 and a height range from 1.05-1.15 may also be increased. For example, in some embodiments, the weight associated with a height range from 0.95-1.05 is increased by 0.7, the weight associated with a height range from 0.85-0.95 is increased by 0.1, the weight associated with a height range from 1.05-1.15 is incremented by 0.1, and other weights associated with other height ranges are respectively incremented by 0.1 in total. In various implementations, the distribution of an amount among the weights is performed according to a Gaussian distribution.

[0068] In various implementations, generating the height histogram includes, for two paired points of the plurality of points (in particular, for each set of two paired points of the plurality of points), determining a height probability distribution of a line defined by the two paired points based on the one of the three coordinates (e.g., the height coordinate) and the uncertainty of each of the two paired points. Generating the height histogram includes determining a length of the line based on the others of the three coordinates of each of the two paired points. Generating the height histogram includes increasing, by an amount scaled by the length of the line, a plurality of the respective plurality of weights of the height histogram corresponding to the height probability distribution of the point. For example, a line defined two paired points of the point cloud may have a height of 1.01, an uncertainty of ±0.25, and a length of 3. Thus, the weight associated with a height range from 0.95-1.05 may be increased, and, also, the weights associated with a height range from 0.85-0.95 and a height range from 1.05-1.15 may also be increased. For example, in some embodiments, the weight associated with a height range from 0.95-1.05 is increased by 0.7 scaled by the length of the line to 2.1, the weight associated with a height range from 0.85-0.95 is increased by 0.1 scaled by the length of the line to 0.3, the weight associated with a height range from 1.05-1.15 is incremented by 0.1 scaled by the length of the line to 0.3, and other weights associated with other height ranges are respectively incremented by 0.3 in total. In various implementations, the distribution of an amount, scaled by the length of the line, among the weights is performed according to a Gaussian distribution. In various implementations, increasing a plurality of respective plurality of weights is performed in response to determining that the line is substantially horizontal (e.g., with a threshold, such as 10%, of being horizontal). Thus, sets of paired points that define lines that are not substantially horizontal are ignored.

[0069] The method **600** continues, at block **606**, with the device generating one or more horizontal plane hypotheses based on the height histogram. Each horizontal plane hypothesis defines a horizontal plane in the gravity-aligned coordinate system and can be specified by a plane equation or corresponding coefficients. Thus, in various implementations, generating the one or more horizontal plane hypotheses includes generating one or more sets of planar coefficients, each set defining a horizontal plane (e.g., a plane normal to the gravity vector).

[0070] In various implementations, the device thresholds the height histogram and generates a horizontal plane hypothesis for each height bin of the height histogram that is above a threshold. Thus, in various implementations, the